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SOIL CONSERVATION DIGEST

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U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

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CALIFORNIA-NEVADA

EROSION COSTS MONEY

By- David N. Morgan

Division of Information and Education

Early October rains of unusual intensity have damaged unprotected lands. All owners should recognize the necessity of controlling erosion. But, strange as it may seem, there are still some people who are content to sit by the fire on a rainy day and permit their fertile soil to wash away, never to be reclaimed. As muddy water rushes toward the sea there is apparently no realization of the loss in dollars and cents to them.

Soil Saving Dams

Where soil saving dams have been constructed in gullies draining farm areas, and where no attempt has been made to control erosion on the fields, the gullies behind these dams fill very rapidly with silt. Visible evidence that this deposited silt came from the cultivated lands above has awakened many to an acknowledgment of the serious problem.

How extensive are these losses? One's own problem can be judged by comparing conditions with those on areas where actual soil and water losses have been measured.

Losses Measured

The SCS has carefully surveyed watershed areas and provided equipment for measuring the water that runs off these areas and, by approved sampling, determined the weight of the soil carried away.

Extreme Case

On some soils, and during some storms, very little erosion occurs. On others only five tons of soil are lost from each acre, others indicate fifty and ninety ton losses. Very extreme and severe losses were measured on the Las Posas Project in January 1935. The amount of soil lost was determined by measurements of typical erosion profiles. The table on page 3 warrants careful study. An understanding of this extreme case should cause every farmer, who clean-cultivates sloping lands, to make a very careful examination and analysis of his own problem.

Storm Described

When this particular storm occurred the soil had already been well saturated with rain water from previous storms, the principal storm having ended at 12:15 P. M. on that day when .73 inches were measured. At 8:54 P. M. a gentle rain started, and up to midnight only .17 inches fell but from then until 3:11 A. M. on the 5th 1.12 inches fell, or a total of 1.29 inches for this storm. In one 15-minute interval one-half inch fell.

EROSION OCCURRING ON THE SMALL DRAINAGE AREA WATERSHED
DURING STORM OF JAN. 5, 1935

Area Number	Area Acres	Eroded Slope Percent	Acreage Eroded	Depth Surface Soil Inches	Estimated Runoff From Eroded Portion - Cu. Ft. (Acre In.)	Average Depth Erosion Inches	Percent of Topsoil Eroded	Cu. Ft. Eroded Per Acre	Total Cu. Ft. Eroded	Tons Eroded Per Acre	Total Tons Eroded
1	32.2	20	23	3	57,300 (0.69) (Ac. In)	1.03	34.3	3,740	86,000	158	3,630
2	57.1	25	23	0	63,700 (0.76) (Ac. In)	1.37	Sub - soil Eroded	4,970	114,300	211	4,850
3	19.8	30	10	5.6	30,400 (0.84) (Ac. In)	1.87	33.4	6,790	67,900	289	2,890
4	23.3	12	20	5	44,300 (0.61) (Ac. In)	0.98	19.6	3,560	71,200	151	3,020
5	74.2	35	32	0	106,200 (0.91) (Ac. In)	1.75	Sub - soil Eroded	6,360	204,000	270	8,650
6	68.8	35	29	4	96,400 (0.92) (Ac. In)	1.60	40.0	5,810	168,500	247	7,170

Little Erosion Occurred on Vegetated Area No. 7

Rainfall Data:

Precipitation: 1.29 inches (8:54 P.M. 1-4-35 to 3:11 A.M. 1-5-35)
Duration: 6 hours 17 minutes
Max. Intensity: 0.48 inches in 14 minutes (2.06 in. per hour)
Av. Intensity Storm: 0.205 inches per hour

Ground Condition:

Well saturated before storm by previous rains, especially 0.73 inch rain of 1-4-35. (Storm ended at 12:15 P.M.)

Run-off
Valued

The table indicates the run-off varied from .61 acre inch to .92 acre inch, which in all cases is more than 50% of the rain that fell. Since pumped water costs approximately \$2.00 per acre inch in this area, the value of lost water that should have been stored in the soil for later crop use was more than \$1.00 per acre.

Amount of
Erosion

And as this water rushed over the sloping lands it carried with it soil equivalent to from .98 inch to 1.87 inches in depth over the entire area of clean-tilled land. The soil actually washed away in this six-hour storm amounted to from 151 tons to 289 tons per acre, or an average loss of approximately 220 tons per acre.

Average Depth
Surface Soil

This amount of soil is practically ten percent of the average weight and depth of surface soil on hillsides protected by native vegetation. For many examinations on the sloping lands of the coastal area of Southern California indicate an average depth of 15" of top soil. But again referring to the table - it is apparent that erosion had taken place on these watersheds prior to the storm, for the depth of surface soil varied from nothing to 5.6 inches. And this 220 tons lost was nearer 30 percent of the remaining surface soil.

Weight of
Surface Soil

A cubic foot of surface soil in this area varies in weight from 70 pounds to 110 pounds. Assume an average weight of 90 pounds per cubic foot and it becomes apparent that 15 inches of surface soil over an acre of land weighs 2450 tons. Again recall that this is only a little more than ten times the amount of surface soil washed away in this one storm reported in the table.

Plant Food
Content

It is well known that the larger part of the available plant food is in the top soil. Complete analyses of thirteen soils, similar to those in the coastal area, made by the California Agricultural Experiment Station, show an average content of the principal soil nutrients, both available and unavailable.

Potash (K_2O)	2.17%
Phosphoric Acid (P_2O_5)	0.204%
Nitrogen (N)	0.105%
	<u>2.48%</u>

Fertilizer
Equivalent

These nutrients that are washed away in 220 tons of lost soil actually amount to 5.45 tons. Inasmuch as when these nutrients are purchased in the form of commercial fertilizer they are in combination with other compounds or fillers, the 5.45 tons are equivalent to 14.68 tons of commercial fertilizer.

It is generally assumed that the large percentage of Potash in our soils is much in excess of actual crop needs. It is, however, valuable and for that reason the full content is used in our computations.

While commercial fertilizers cost the growers approximately \$40.00 per ton plus the cost of application, we do not feel free to assume that value for the equivalent nutrients in soils for the reason that all of these nutrients are not immediately available for plant use as they usually are in commercial fertilizers.

Value Assumed
for
Fertilizer
Equivalent

After discussions with experienced agricultural chemists and soils men, it is believed that a very fair value to place on these equivalents is 10% of the price of commercial fertilizers, or \$4.00 per ton. Since there is the equivalent of 14.68 tons of fertilizer in 220 tons of soil, and it is assumed that it is worth \$4.00 per ton, the value of the nutrients washed off by this single storm was nearly \$60.00 per acre.

Fertility
Should Be
Maintained

The average annual application of commercial fertilizers exclusive of organic material costs the citrus growers of California approximately \$12.00 per acre. While the citrus growers have an appreciation of the value of soil nutrients, there are still some farmers who, through incorrect farm practices and the ignoring of erosion control methods, appear satisfied to permit \$60.00 per acre to be washed out of the soil, while their neighbors are paying \$12.00 per acre in an endeavor to maintain soil fertility.

Known Methods
of Control

In this storm of January 4 and 5, 1935, five times as much valuable plant food was lost in six hours as is ordinarily purchased with good hard cash. And the washing and loss of this soil can be prevented. Methods are known and are being put into effect on demonstration areas by the Soil Conservation Service. Farmers outside of these areas may also have erosion problems. If fields are filled with small rills after a storm, soil is being lost. Discuss with the County Farm Advisor; he will gladly help.

CONSERVATION OF WILDLIFE
By Floyd H. Venable, Regional Biologist

Plainly stated, wildlife management is essentially the encouragement of desirable species of birds and animals through improving their environment. In the past we have ruthlessly exploited our wildlife resources and have attempted to protect the game that is left through the establishment of "bag limit" laws, and similar legislation. Despite this attempt to protect our game species the need has been seen by various groups of biologists and conservation-minded sportsmen for more adequate methods of handling the problem. Legislation alone is not the answer. A sense of individual responsibility for our wildlife resources and an appreciation of its needs will be necessary in order to promote a successful conservation program.

Game Is in
Annual Crop

Exceptional opportunities for promoting wildlife welfare are presented by a comprehensive soil conservation program and it is the aim of the Service to establish wildlife conservation as a sound agricultural practice in connection with these activities. The principal objectives toward which the wildlife program are directed includes the avoidance of acts detrimental to wildlife; the improvement of conditions for the desirable forms of wildlife; and the development of an annual crop of game, as a means of providing supplemental farm income or compensation for lands not under cultivation.

The fundamental principle of wildlife and game management is the creation and maintenance of a satisfactory environment which includes a continuous supply of food and water, and sufficient cover for nesting, emergency protection against natural enemies and weather. It is the purpose of the Soil Conservation Service, Section of Wildlife Management, to integrate the principles of wildlife conservation in this program so that trees, shrubs, and other vegetation employed for soil erosion control will serve, wherever practicable, as a source of food and shelter for desirable birds and animals. There are various ways in which the environment for wildlife may be improved, as outlined below.

Wildlife
Refuge

An area in which woodland trees may not be grown successfully or areas in which the cooperater desires to sponsor wildlife welfare may be developed into a wildlife refuge or sanctuary. The ideal planting for a wildlife refuge is to locate clumps or units of cover

about 50 feet apart, and plant the spaces in between with seed-producing plants suited for erosion control. These cover units should consist of three or four ever-green trees surrounded by a zone of food-producing tall shrubs, approximately six feet wide, and then a row or two of low shrubs. When fully developed such units will afford ample escape cover for roosting and nesting many different species of birds. The open areas, when seeded to such plants as bur clover, wild buckwheat, barley, wheat, etc., will furnish abundant food for many species. One watering station located near one of the cover units should be sufficient for an area of less than one up to several acres.

Border Planting

It is considered good practice to plant at least one row of tall shrubs and one or two rows of low growing ones along the outer edge of woodland plantings, especially where the trees are adjacent to farm crops. This type of planting offers less root competition to the cultivated crops, and also reduces the fire hazard to the woodland, and at the same time affords an excellent escape cover and some food to wildlife.

Inter-planting

In addition to, or instead of, the above, a cooperator may wish to interplant food producing species to encourage a greater wildlife population. This may be accomplished by alternate planting of such species, or a more or less intensive planting, depending upon the particular situation.

Wildlife Lanes

On larger areas where neither of the above may be desirable it is recommended that wildlife lanes be planted to desirable food-producing trees and shrubs. The inclusion of wildlife lanes would depend upon field conditions such as area involved, need for additional fire protection, roadways, and other factors. Fire trails cut through dense woods or chaparral greatly increase the feeding area or "edge land" for wildlife and thereby perform the function of a wildlife lane.

Barrancas

In controlling erosion along broad deep barrancas it is desirable, from the standpoint of wildlife welfare, to plant considerable areas of the sloping banks to seed-producing plants such as bur clover, wild buckwheat, barley and other seed-producing plants.

Along the bottom of the gully on both sides of the channel up to the high water mark, low-growing shrubs may be planted with the grasses. Where the banks



are long and sloping it is desirable to plant an occasional clump or unit of cover trees and shrubs. Clumps of medium or low-growing shrubs planted along gullies afford escape cover for wildlife, which feed on plant seeds along the banks.

III Effects
of Fire and
Overgrazing on
Wildlife

In addition to the recommendations listed a modification of harvesting operations on hay lands, or modified grazing, so as to prevent destruction of bird life, should be considered. Fire prevention is also necessary if food and cover requirements of wildlife are to be maintained. The following quotation from "The Western Range," page 345, points out the effect of fire and overgrazing on quail: "Deterioration of habitat, through depletion of the range, has furthermore resulted in decrease of upland game birds. A good example of this is in the thinning out of quail in the San Joaquin Valley region of California. Quail formerly inhabited the valley by the thousands, and the finest part of their habitat was in the brushy foothills. Overgrazing of these foothill areas and the extensive use of fire in an effort to improve forage has destroyed much of the perennial herbaceous vegetation and low shrubs that furnish not only cover but also food for the quail. The result is an estimated decrease of birds of 25 to 30 percent within the last 15 years."

Watering
Stations

The California quail and other game species require water in some form (as free-water or in succulent vegetation) throughout the year. On much of the territory within the California-Nevada Region there is neither succulent vegetation nor a free-water supply during the hot, dry summer months. Consequently quail and other game will migrate to territory adjacent to some annual water supply. This often results in over-population of these favored areas and considerable competition for food in the area about the water hole.

Where the cooperator desires to increase the wildlife population in such areas on land taken out of cultivation, it is recommended that he establish watering stations wherever practical, in sufficient numbers to accommodate the wildlife population. Young quail, apparently, are not able to travel farther than a quarter of a mile to water. In order to furnish optimum drinking facilities for quail, watering stations should be placed not farther than one-half mile apart, preferably not farther than one-fourth mile apart.

When a pipe line extends across or near the game refuge, or brush land, a T may be inserted in the line nearest the proposed watering site and a pipe leading to the container, terminating in a float valve, installed. If the water must be carried any great distance, pipe of small diameter is suggested. A cement basin, with a gradual slope, may be used for the container. These basins should be placed in close proximity to escape cover so that the birds or animals using the water can escape from predators.

Control of
Predators

Control of predatory species, including coyotes, bobcats, hawks (sharpshin and crows), and domestic cats, may at times be necessary, but if given proper environment the desired species will normally take care of themselves.

Returns to
the farmer

Returns to the farmer from a system of wildlife management usually include:

- (1) Increased meat for his own table
- (2) Control of insect pests and rodents
- (3) Recreational values
- (4) Cash income

Game
Management

In some of the states east of the Rockies many farmers have turned game birds and animals into a cash producing crop by selling shooting rights to sportsmen. Sportsmen have been more than willing to pay this fee in exchange for good hunting. It is hoped that a similar revenue producing plan may be worked out that will generally apply to Region 10. Both profit and recreation are possible through the development of such a plan.

On some Michigan farms the farmer sells hunting tickets, which not only allows him to keep track of hunters but aids in the control of trespass. A fee of \$4 per day, or less, is charged by some Texas farmers for the privilege of hunting on their lands. On Iowa game-managed farms a fee of fifty cents, or less, per bird is charged. In some southern states it is customary to charge from ten to twenty-five cents an acre for hunting privileges.

WINTER GREEN MANURE COVER CROPS FOR CALIFORNIA

By C. W. Cleary, Jr.

Assistant Regional Agronomist

The importance of a green manure cover crop cannot be over-emphasized. The value is twofold. A vegetative cover on the ground during the winter is of great value in preventing soil losses, and the organic material which is incorporated in the soil when the crop is turned under improves soil fertility and physical condition.

Legumes Best

Leguminous crop plants are the most widely used and most valuable green manure plants. The addition of nitrogen to the soil by plants of this group makes them very useful in soil improvement work.

Non-leguminous plants are used in some cases because of special characteristics, such as large and rapid growth, growth at a lower temperature, heavy or fibrous root systems, or cheap and readily available seed, which make them of value. When such crops are used, nitrogen is often added in the form of commercial fertilizers.

Cereals in Cover Cropping

In cover cropping on slopes where protection from soil washing is an important factor the cereals are very valuable. Rapid growth at lower temperatures and fibrous root system serve to give early protection from soil washing. Best results are likely to be obtained with spring varieties. The strong winter habit of winter types causes less growth in cool weather.

Legumes and Cereals

A combination of a cereal and a legume is a general, quite standard, practice because of the early protection against soil washing while the legume crop is becoming established, and because of the support afforded such crops as peas and vetch by the cereal stems.

In northern and central California it is often found desirable to increase seeding rates from 10 percent to 20 percent to insure an effective cover.

The attached charts* have been prepared to give a comparison of the value and cost of various crops used for green manure. In some sections operators may be able to buy seed at prices less than those quoted.

*These charts have been checked and approved by the California Agricultural Extension Service.

WINTER GREEN MANURE COVER CROPS FOR CALIFORNIA

Cover Crop and Remarks	Rate Acre Along	Rate Acre Mix- ture	Cost Acre Approx Along	Cost Acre Approx Mix.	Soil Adaptation	Climatic Adaptation
COMMON VETCH Less winter hardy than Hairy Vetch. Makes less growth during cool months than Purple Vetch.	60 $\frac{1}{2}$	40 $\frac{1}{2}$	\$ 1.30	\$ 1.20	Medium to heavy texture. Well drained	All California Except regions of severe win- ters. Well adapted to in- terior valley.
PURPLE VETCH Produces well and makes good growth dur- ing cool months. Least winter hardy of the vetches.	40 $\frac{1}{2}$	25 $\frac{1}{2}$	\$ 2.60	\$ 1.60	Medium to heavy texture. Well drained.	Localities of mild winters. Coastal sec- tion.
HAIRY VETCH Very winter hardy. Strong winter habit causes winter dormancy and less growth during cooler months. Reseeds well and volunteers readily.	25 $\frac{1}{2}$	18 $\frac{1}{2}$	\$ 2.65	\$ 1.90	Especially good on light or sandy soils.	Best in colder localities.
AUSTRIAN WINTER PEA Very winter hardy. Strong winter habit causes winter dormancy and less growth during cooler months. Shallow but extensive root sys- tem. Less damaged by aphis than the vetches and for this reason should be used where aphis injury to vetch is an important factor.	60 $\frac{1}{2}$	40 $\frac{1}{2}$	\$ 3.00	\$ 2.00	Medium texture Well drained.	Best in cooler localities. Well adapted in interior valleys.
HORSE BEAN Small-seeded type Produces very well in the Coastal Section.	60 $\frac{1}{2}$	40 $\frac{1}{2}$	\$ 3.90	\$ 2.60	Medium and light texture soils. Well drained.	Localities of mild winters.

Cover Crop and Remarks	Rate Acro Alone	Rate Acro Mix- ture	Cost Acro Approx Alone	Cost Acro Approx Mix.	Soil Adaptation	Climatic Adaptation
WHITE SWEET CLOVER YELLOW SWEET CLOVER (Biennial) Makes very little growth during cold weather. Produces good bulk of material in warm seasons. Deep tap root valuable in breaking up heavy soils. Not well adapted for annual, winter, green manuring.	15 ⁰⁰ / ₁₀₀	10 ⁰⁰ / ₁₀₀	\$.75	\$.50	Wide range of soil types. Fairly tolerant of alkali.	Adapted to most climatic conditions found in California.
BITTER CLOVER YELLOW TOP Low cost of seeding has been a factor in popularity. Produces good bulk. Does not make as much growth at lower temperatures as vetch. Very high fertilizing value.	15 ⁰⁰ / ₁₀₀	10 ⁰⁰ / ₁₀₀	\$.60	\$.40	Wide range of soil types. Does not do very well in acid soils.	Wide range of climatic adaptations.
HUBAM CLOVER Characteristics similar to Bitter Clover. Not well known in the west.	15 ⁰⁰ / ₁₀₀	10 ⁰⁰ / ₁₀₀	\$.75	\$.50	Wide range of soil types. Does not do very well in acid soils.	Wide range of Climatic adaptations.
BUR CLOVER Occurs naturally over a very wide range in California. Good winter grower. Does not produce large tonnage. Early seeding habit makes bur clover a valuable volunteer crop.	15 ⁰⁰ / ₁₀₀	10 ⁰⁰ / ₁₀₀	\$.90	\$.60	Rather wide adaptation. Fairly tolerant of alkali and does fairly well on soils low in lime.	Adapted to Coastal Section and interior valleys. Will not stand much cold.
FILARET Chief value is early seed habit, enabling the crop to volunteer even where spring cultivation is fairly early.			Impractical to sow for green manure.		Medium texture. Well drained.	Localities of milder winters.

[illegible]

